PROGRAM APPROACH TO THE ENVIRONMENTAL MANAGEMENT IN THE REGION[1]

Olga P. Burmatova[2]

The paper is devoted to the main methodological and methodical aspects of the development of the strategies for the protection of the environment on the example of the Novosibirsk region. The logic diagram of development of the strategy of environmental activities in the region is shown. Major environmental problems of the Novosibirsk region and their possible solutions are identified. The system of environmental protection measures determining the need to mitigate or prevent potential environmental problems is proposed. Calculations forecast air pollution area on the most common pollutants emitted from stationary sources in the period until 2025 with taking into account environmental measures, are fulfilled. The results of the research allow carrying out a more informed choice of the main directions of environmental activities in the region under consideration, which avoid the possible risks and the best use of available resources. All of this is a prerequisite for the formulation of priorities in the environmental field and the development of strategies for the protection of the environment as an element of social and economic development of the region as a whole. Recommendations were made to improve the management mechanism of the regional eco-economic system.

APPOINTMENT OF AN ENVIRONMENTAL PROGRAM

One of the most important tools of management of the environmental sphere of the region and of forecasting its condition is strategic planning. The strategic planning process provides the basis for managing the region as a whole and its individual spheres, including, in particular, environmental. Development of a regional environmental strategy involves determining the environmental mission of the region and its ecological image of the future, the choice priority objectives and goals, detailing their in specific projects and programs, developing mechanisms for implementation, analysis and evaluation of results and consequences of implementing projects and programs. Consider the example of the Novosibirsk Oblast the main methodological aspects of the development of environmental strategy.

The Novosibirsk region environmental policies are aimed at maintaining the integrity of natural systems and providing a favorable environment for people. At the same time it's necessary to consider that not only is a lot of accumulated in the past and so far unresolved environmental problems, but also the fact that the prospects of socio-economic development of the region associated with a possible further increase of the load on the environment. This, in turn, determines the relevance of development and implementation in the medium and long term, an adequate system of environmental measures that could form the basis for the strategy of environmental activities in the region and, consequently, to determine the main directions of improving the environmental regulatory system in this region that minimize the negative impacts of human activities on the environment and in general of ecological safety of the economic development of the Novosibirsk region.

[1] This article was prepared as a part of the 7th Framework Programme FP7-PEOPLE-2011 IRSES Project No. 295050 FOLPSEC – Functioning of the local production systems in the conditions of economic crisis (comparative analysis and benchmarking for the EU and beyond).

[2] Assoc. Prof., PhD, Senior Researcher, Institute of Economics and Industrial Engineering, Siberian Branch, Russian Academy of Sciences (IEIE SB RAS), Novosibirsk, Russia.

The basis of the system of prediction of the environmental situation in the Novosibirsk region is the development and implementation of a number of interconnected documents, including the following elements:

1) the section «Ensuring environmental safety and environmental protection» as part of the Strategy for Socio-Economic Development of the Novosibirsk region for the period up to 2025 [1];

2) long-term target program «Environment of the Novosibirsk Region» within the Programme of the Socio-Economic Development of the Novosibirsk region up to 2015 [2, 3];

3) subsection «Solving the environmental problems» of the Strategy of socio-economic development of Siberia up 2020 (Section IV. Priority Interbranch Development Directions of Siberia) [4, 5].

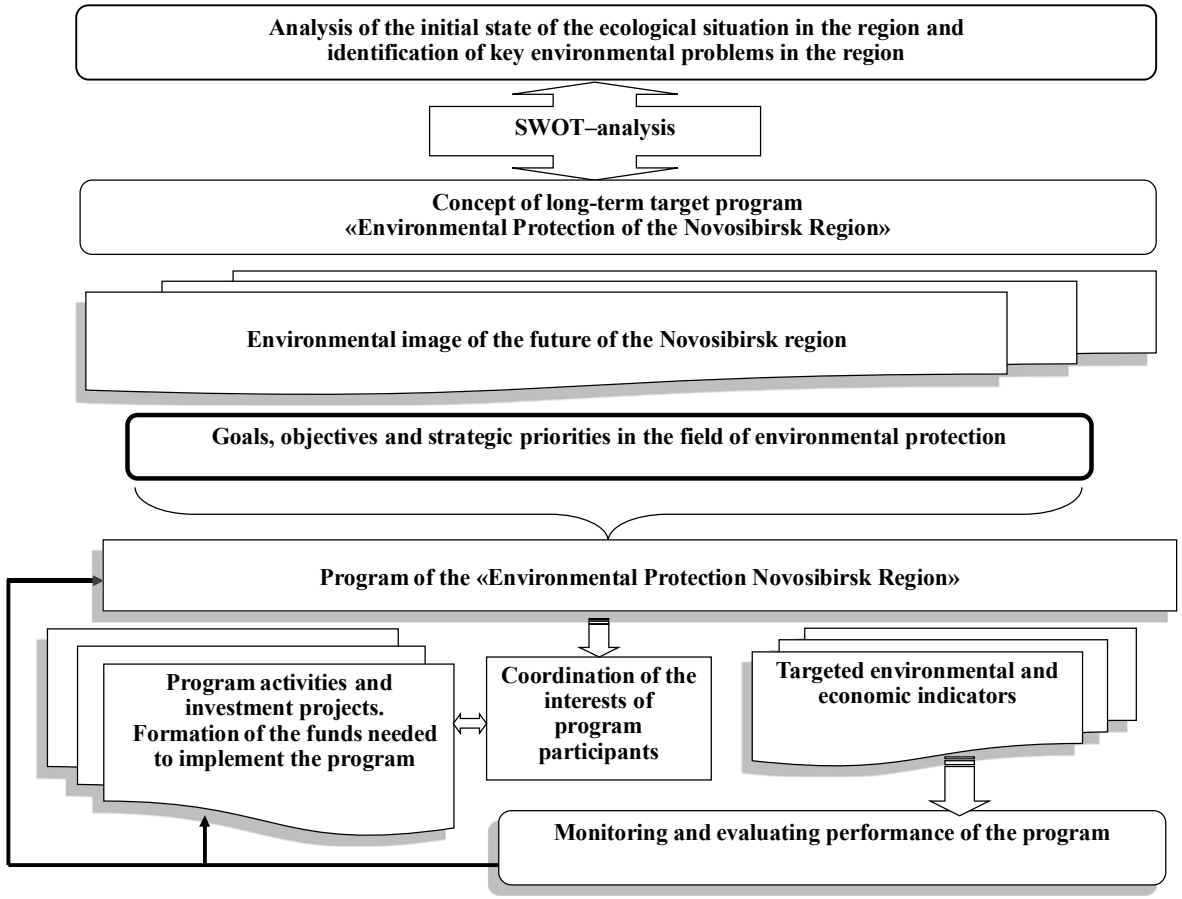

Fig. 1. Structure and scheme of the process of the development and implementation of the Program «Environmental Protection the Novosibirsk region»

It is important to note that forward-looking strategic developments in the field of environmental protection are part of the general system of strategic planning documents of socio-economic development in the region [5, 6, 7, 8, 9] and have a close connections with economic and social issues in the region, as oriented on a comprehensive solution economic, social and environmental problems. In accordance with this, the formation of long-term target program «Environmental Protection Novosibirsk Region» (hereinafter – the Program) suggests as a first phase the elaboration of the project concept of this program, which are built with taking into account the connection with the Program of socio-economic development of the Novosibirsk region in 2025 [1, 2, 7]. The concept of long-term program «Environmental Protection the Novosibirsk region» is intended to further the formation of the long-term program, as well as definitions of the main contours of

the internal structure of the section dedicated to environmental protection, its place in the program of socio-economic development of the Novosibirsk region and the total system of strategic planning area.

Development and implementation of the Program should begin with an analysis of the initial state of the environment in the region and should end with the elaboration of defined measures for the desired adjustments of the nature management and forming a healthy environment within the territory under conditions of the quality control of the entire process of development and implementation of the Program, the necessary coordination in the relevant activities and evaluation of the results (Figure 1).

FACTORS AFFECTING THE DEVELOPMENT OF THE ENVIRONMENTAL SITUATION IN THE REGION

Regional environmental policy is largely dependent on how adequately factors affecting the development of the environmental situation are taken into account. Analysis of these factors in relation to the possibility of the environmental governance allows identifying the most significant for a specific period of time environmental problems and offer the ways for their solutions. It is important to be clear about whether the critical factors amenable to be controlled by the environmental agencies are internal or external within the scope of regulation of environmental field or external conditions on which the regional authorities are not able to affect directly.

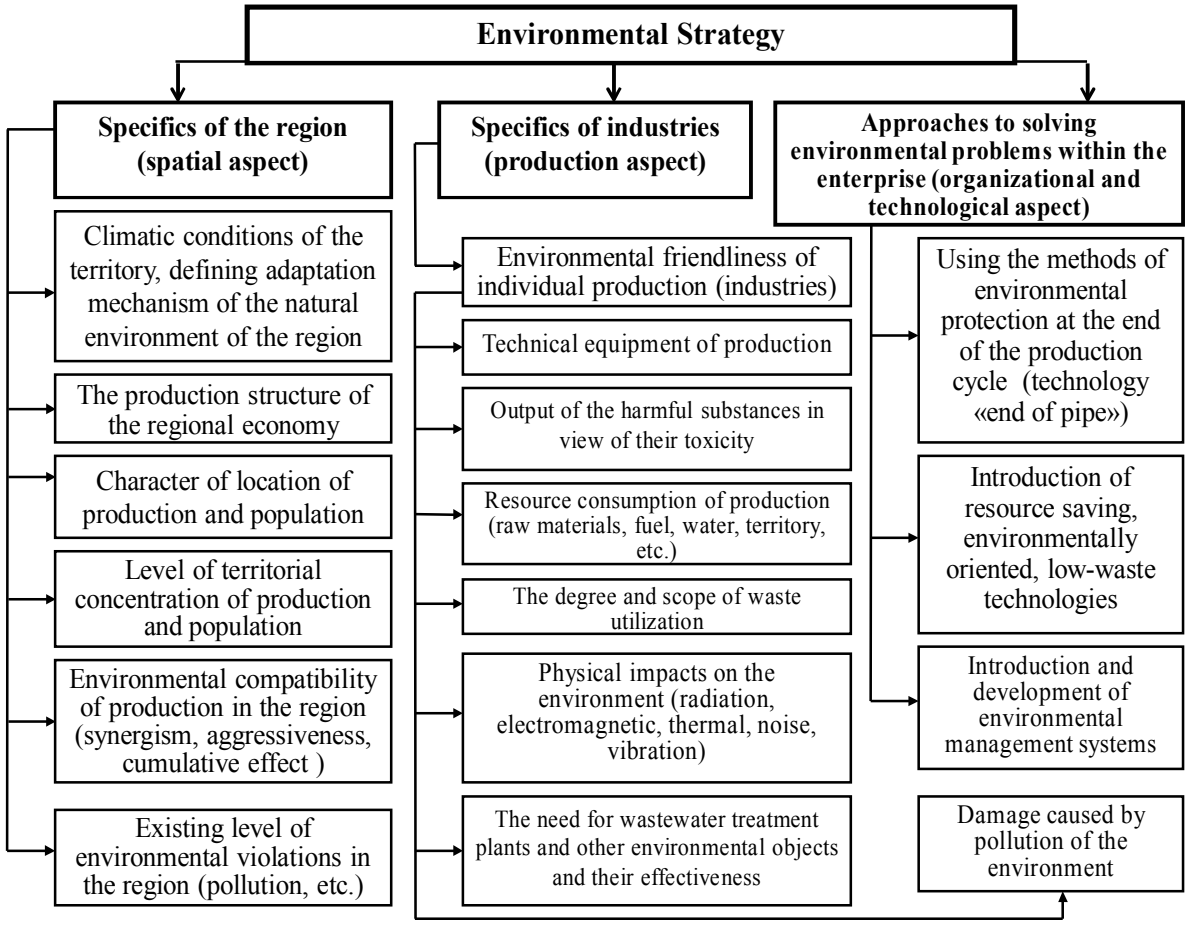

Fig. 2. Factors influencing the choice of environmental policy in the region

In every region of the environmental situation , priority environmental issues and finding approaches to their solution are determined, as a rule, by three groups of aggregated factors (Figure 2): 1) the specific conditions of the region; 2) industry features productions that are presented in the region; 3) approaches to environmental problems within the individual businesses.

Results of imposition of these factors on the territory of the Novosibirsk region testify that from the standpoint of the formation conditions of the environmental situation, the region relatively lucky only with branch structure of production (meaning first of all the absence of typical polluting industries). For the remaining factors the situation is sufficiently urgent that in the perspective of socio-economic development of the region under study determines the urgency of developing and implementing the necessary environmental measures that form the basis of the program in the field of environmental protection and determine the main directions of improving the system of environmental management in the region.

Fig. 3. Features of the Novosibirsk region from positions forming the ecological situation (Favorable factors are marked in italics)

Features of the environmental situation in the Novosibirsk region and emerging environmental problems are mainly caused by local climatic conditions and character of influence on them the region's economy (industry, energy, transportation, utilities and agriculture), which in turn depends largely on the specific location of industrial enterprises, their capacities, technologies used, the extent of the territorial concentration of production and population, the existing level of a violation of the natural environment in the region and other conditions. Concretization of these conditions with respect to the considered region is shown in Figure 3.

Projected in the Novosibirsk region economic development involves the growth of the fuel industry, ferrous and non-ferrous metallurgy, chemical industries, construction materials industry (cement) and freight turnover transport [1]. This can lead to increased pressure on all parts of the environment that will require conducting adequate environmental measures.

ANALYSIS OF THE INITIAL STATE OF THE ENVIRONMENT AND THE MAJOR PROBLEMS

Modern ecological situation in the Novosibirsk region is very heterogeneous both in component and in the territorial context. With respect to the elements of the environment stand out above all air pollution, water pollution and land disturbance associated with the placement of solid waste production and consumption. With regard to the territorial aspect, environmental impact differs sharply according to the city area. By the level of environmental pollution cities and regions may be divided into three groups. Novosibirsk refers to the first category, where a high concentration of industrial production and population results in an increased flow of pollutants into the environment of the city, posing a threat to a human health. With a large margin from Novosibirsk are followed Kuibyshev Iskitim, Berdsk, Barabinsk, Tatarsk, Linevo. And finally, the third group includes all other cities and districts of the region.

Main indicators characterizing the state of the environment in the territory of the Novosibirsk region from positions of atmospheric air, water basins and waste in the dynamics are shown in Table 1 [10, 11, 12, 13, 14, 15].

Quite a strenuous situation in the region is connected with the air pollution, although environmental activities carried out in enterprises of Novosibirsk and area (in particular, technical re-equipment of «Novosibirskenergo», transition from coal to gas of a number of boilers and others) allowed to lower its sharpness. In the structure of total emissions to the atmosphere in the region (Table 1) is allocated the motor transport (about 61% of the total emissions of the area in 2008, 60.5% – in 2009 and 55.1% – in 2012). The contribution of other sources of pollution in 2012 was as follows: industry – about 20.9% combined heat and power and heating boilers with housing and communal services – 24%.

Emissions from stationary sources have been relatively stable in the past 10 years, while the amount of pollutants received from air emissions from motor vehicles, from 2004 to 2009 grew and in 2009 began to decline. This decrease is attributable to a decrease in the share of trucks and buses in the vehicle fleet structure of the region (33.6% and 16.3% respectively in 2011, while increasing the share of passenger cars by 7.6%).

Problem of drinking water quality and pollution of water bodies in the Novosibirsk region remained rather sharp. Although the provision of region by water resources is quite high, but the quality is poor. Modern state of the majority of water bodies and coastal areas is not in compliance with environmental and town planning requirements. The situation is exacerbated by the high content in water of iron and manganese of natural origin. Pollution and groundwater as the main source of drinking water is increased. Practically every district

of region is characterized by inadequate water supplies and poor quality of drinking water. This is primarily due to water shortage in some areas, as well as deterioration of structures and networks of drinking water supply. More than 1 million residents of the region drink poor quality water.

Under the terms of drinking water supply from fresh groundwater, among territories of the Novosibirsk region by water with mineralization up to 1 g/l are provided mainly northern parts of the region, part of the left bank of the Ob river, the right bank and the southern parts of Karasuk and Krasnozersk districts. In the rest of the region under consideration the water supply of population can be satisfied, under the resolution of public sanitary inspection, from the groundwater with mineralization advantageously from 1 to 1.5 gram/liter. Under unfavorable conditions exist western regions (Tatarsk, Chany), where groundwater of all the major aquifers have mineralization from 1.5 to 3 g/l. High quality drinking water in the area is typical for Novosibirsk thanks to the work of company «Gorvodokanal». In the last years there has been a trend of gradual reduction of volumes fresh water intake (Table 1).

Table 1

Main indicators characterizing the impact of economic activity on the environment the Novosibirsk Oblast*

Indicators	The year						
	2005	2007	2008	2009	2010	2011	2012
Extraction of water from natural water bodies – total, million m^3, including:	836,0	768,0	835,6	755,2	763,6	676,0	703,9
– from surface water bodies	734,5	673,5	738,7	659,5	696,5	613,4	642,8
– from underground sources	101,6	94,6	97,0	95,7	67,1	62,6	61,1
Wastewater discharges into surface water bodies total, million m^3, including:	615,7	568,7	624,6	588,2	604,2	527,1	544,2
– discharge of polluted wastewater, million $м^3$	72,5	101,5	104,6	98,4	106/ 48,3***	92/ 34,9***	112,5/ 40,1***
– discharge normatively treated wastewater, million m^3	271,4	250,5	273,0	254,1	280,18		
Air emissions, thousand tons: – from stationary sources	213,2	204,0	231,5	233,5	228,4	234,0	224,5
– from motor vehicles	287,8**	365,7**	358,0**	358,4	319,9	287,4	286,2
Pollutant emissions from stationary sources, per 1 inhabitant, kg	80,5	88,7	100,7	88,1	85,7	87,1	83
Waste generation of production and consumption, million tons	1,98	1,68	1,74	1,91	2,07	2,5	1,8

Notes:

* The table is compiled using data of the Novosibirskstat and the Department of Natural Resources and Environmental Protection of the Novosibirsk region, as well as sources [10–15].

** Calculations are made by the Department of Natural Resources and Environmental Protection of the Novosibirsk region under the simplified procedure developed by «SRI Atmosphere», using specific emission factors.

*** In the denominator polluted waste water without treatment is indicated (in total volume of wastewater discharges).

Water pollution is primarily associated with industrial activity and functioning social and domestic sector. The main sources of pollution of water bodies in the Novosibirsk region are housing and utilities of the cities Novosibirsk, Kuibyshev, Barabinsk, Cherepanovo and Tatarsk, and a number of industrial facilities. The main pollutants in the Ob river basin are nitrogen compounds, oil products, phenols and iron. At the same time small rivers are polluted to a much greater extent than the Ob, which, being one of the most full-flowing rivers in the country, has a high self-cleaning ability. From the point of view of the level of pollution of surface water sources, evaluated by an index of water pollution, water quality main river of the region – Obi – estimated in its entirety within the Novosibirsk region as referring mainly to classes IV and V (i.e., as contaminated water and dirty). Among the most polluted water bodies in the region are the Novosibirsk Reservoir, the Lake Ubinskoye and surface water sources in the area of the Maslyanino and Iskitim. Here water quality corresponds to V and VI classes, i.e. it is dirty and very dirty. Among the main types of pollutants are allocated petroleum, detergents, phenols and chlorides.

Serious problem in the region (especially in Novosibirsk) is the efficient management of waste of production and consumption (Table 1). Every year in the regional center about 2 million m^3 of waste are produced, including 800 tons of municipal solid waste (MSW), which is more than 530 kg per person per year. The main problems are connected with municipal solid waste, unusable plant protection products, mercury-containing wastes. The overwhelming majority of waste generation (nearly 70%) refers to waste hazard class V. Most of them large-capacity – ash and slag wastes of «Novosibirskenergo» and municipal waste. 85% of the total waste production and consumption in the region is formed by three types of activities: a) the production and distribution of electricity, gas and water; b) at the facilities of agriculture; c) at the manufacturing enterprises.

Accumulation of waste production and consumption is accompanied by increased size of the territory occupied by them (today Novosibirsk, Berdsk and other settlements of the region experiencing a shortage of land for placement of waste). Due to the lack of specialized multi landfills (disposal) of hazardous industrial wastes, many companies are forced to temporarily store waste at industrial sites. Unorganized dumps of industrial and household waste are generated spontaneously and are located mainly in floodplains, ravines and forest areas. Currently in the Novosibirsk region there are 1034 municipal solid waste landfills, including 670 unauthorized. Processing of most types of waste production and consumption is hampered by lack debugged system of collection. Low level of using waste production and consumption leads to the fact that the bulk of the waste is located on the objects of the long-term storage (more than 1.3 million tons) [11].

Besides characterized aspects of the formation of the ecological situation in the Novosibirsk region to the number of acute problems rather should also include: soil pollution, desertification and degradation of vegetation; reduction of the species composition of flora and fauna; safety operation of hydraulic structures, preservation, reproduction and rational use of natural resources; safety operation of hydraulic structures, preservation, reproduction and rational use of natural resources; air pollution in the zone of fire unauthorized dumps full of municipal solid waste; contamination of soil, groundwater and surface water at the locations of waste dumps; flooding of settlements; business waste storage plant protection products; condition of hydraulic structures, processing of the Novosibirsk reservoir shores; natural focal infections (encephalitis).

Based on the analysis of the environmental situation in the Novosibirsk region one can formulate environmental vision of the future of the region, the challenges in creating favorable environmental conditions, as well as identify strategic environmental priorities and directions of the environmental performance [16].

ENVIRONMENTAL IMAGE OF THE FUTURE OF THE REGION, THE CHALLENGES IN CREATING A FAVORABLE ECOLOGICAL SITUATION, STRATEGIC ENVIRONMENTAL GOALS, OBJECTIVES AND PRIORITIES

The main elements of the image of the future of the region must be such characteristics that suggest improvement in the quality of the natural environment and ecological conditions of human life, including a healthy environment, the greening of production, creation of effective environmental sector and the conservation and protection of nature (Figure 4). Formation of ecological vision of the future (which, however, in territorial aspect is versatile enough because it is formed on the basis of common social, economic and environmental requirements) provides for forming of such foundation on which perspective should be the necessary conditions in order to make the harmonious interaction of economy and ecology in the region by reality.

Fig. 4. Environmental image of the future of the region

In modern conditions of economic development the main challenges in the formation of the ecological situation in the regions of the country conditioned by the following circumstances:

1) the transition to new standards of life and environmental safety, the introduction of resource-saving and environmentally sound technologies;

2) the weakness of the modern state of environmental policy in the Russian Federation;

3) imperfection of the techniques to determine of economic damage caused by the economy and health by pollution of the environment;

4) low investment activity among the nature users into the conservation activities;

5) weak economic interest of the nature users in the complying with environ-mental requirements;

6) the imperfection of statistical reporting on the use of natural resources and protection of the environment, lack of control of financial discipline in the field of resource and environmental charges;

7) the tightening of conditions for access to international markets from the viewpoint of environ-mental standardization and regulation;

8) increasing international competition due to increasing demands for environmental quality and safety, the transition to the taking into account the environmental parameters of technologies used for production;

9) low environmental responsibility of business and generally low ecological culture of people.

Basis of environmental activities of the Novosibirsk region is composed of identified and formulated already existing environmental problems, and of those that may arise in the process of the planned investment projects implementation, as well as of the system of environmental protection measures which are determined by the need to mitigate or prevent potential environmental problems (Table 2).

The development and implementation of the regional environmental program include the following sequence of actions (Figure 5).

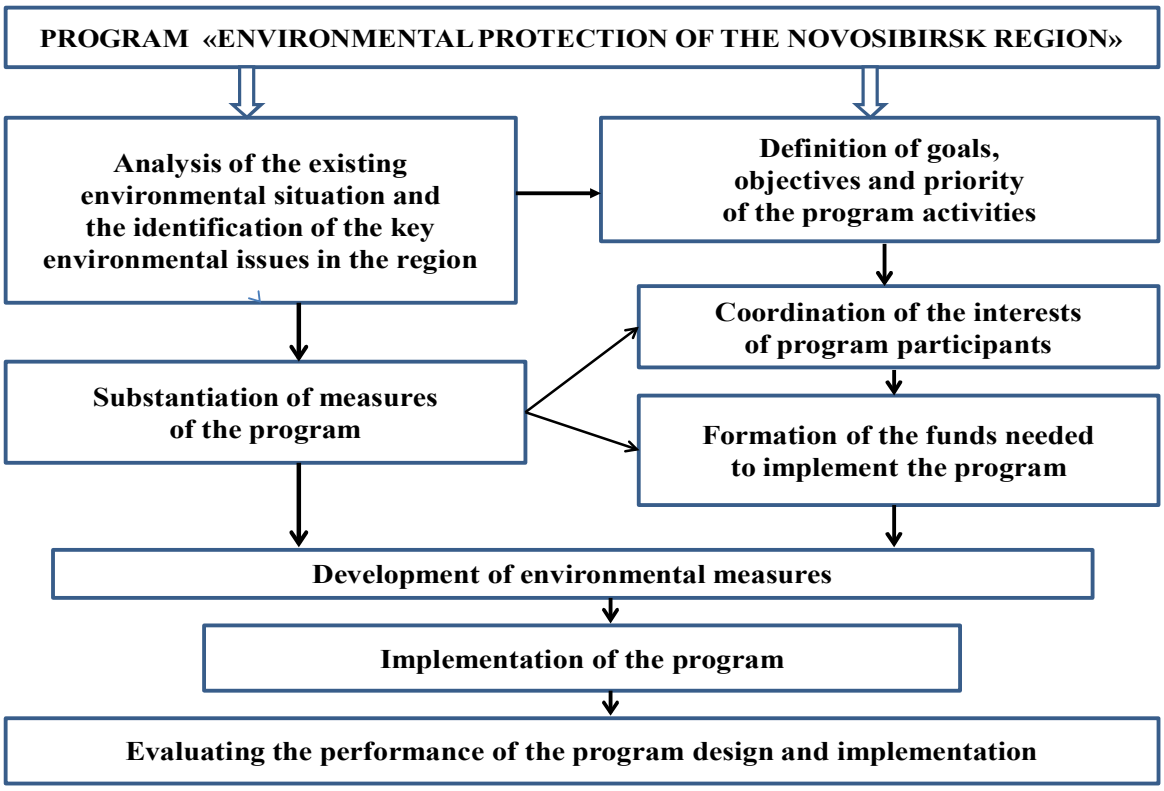

Fig. 5. Scheme of the process of development and implementation of the Program «Environmental Protection Novosibirsk Region»

In accordance with the represented logic, consider the basic steps of development strategies for environmental protection in the region, including the formulation of strategic goals, objectives and priorities in the field of environmental protection in the region, substantiation of necessity of the decision problem in the framework program-goal approach, possible solutions to the problem.

Strategic goal of the regional environmental program can be formulated as providing the environmental safety of the Novosibirsk region due to stabilization and environmental improvement, preservation and restoration of the integrity of natural ecosystems.

These goals could through the following objectives:

1. Meet the needs of the population and economy of the region in various kinds of natural resources on the principles of an integrated, efficient and rational use.

2. Maintaining and improving the quality of the environment, reducing the negative impact on it in the conditions of the innovative development of the regional economy.

3. Protection of the population, economic facilities and the region from the harmful effects of water.

4. Creation of a waste management system of production and consumption.

5. Ensuring the radiation safety of the territory, reduction to a socially acceptable level of risk of radiation impact on man and his environment.

6. Implementation of measures for the protection and reproduction (restoration) of renewable natural resources as environmental components.

7. Compliance with environmental regulation of economic activities involving compliance of its scope and risk of exposure to environmental capacity of natural systems.

8. Developing a network of protected areas and biodiversity conservation.

9. Improving the management system and mechanisms regulating the use of natural resources and environmental protection.

10. Increasing the level environmental education, promotion caring attitude towards nature.

Basis of environmental activity of the Novosibirsk region consists in the identified and formulated environmental problems, which as have been established in its territory and may arise in the process of implementation of the planned investment projects, as well as the system of environmental protection measures, determined the need to mitigate or prevent potential environmental problems (Table 1).

Achieving the goals and objectives is aimed at addressing health improvement of the environment within the Novosibirsk region, reducing the anthropogenic load, maintaining acceptable levels of air pollution from stationary and mobile sources of emissions, organization of rational use and protection of water resources, improvement of the treatment of waste production and consumption, as well as identifying possible directions of improving control mechanisms in the field of environmental protection. Orientation to manufacture high-tech products, realization of the project on gasification of industrial and household sectors of the region and other projects provided for in the Novosibirsk region in the long term, will contribute (along with carrying out the conservation measures) improve environmental performance of the economy of the Novosibirsk region. Exit to the intended target environmental guidelines will testify about the possibility of not only preserving the achieved quality of the environment (primarily due to air quality), but also its progressive improvement.

In accordance with the goals and objectives of the Program, as well as the main provisions of the Strategy for Socio-Economic Development of the Novosibirsk region in 2025, the general strategic priorities in the field of environmental protection are as follows.

1. Increased use of environmentally sound technologies (both existing and projected on to the creation of industries) with goal to provide the technological basis for environmentally sound development of economic activities in the framework of the transition of the economy of the region and the whole country on the path of innovative development.

2. Supplying enterprises with environmental equipment, technological re-equipment and phasing-out of enterprises with obsolete equipment, a reduction in specific water consumption in production and housing and communal services, the development of systems of secondary resources, including waste.

3. Ensure environmental regulation of economic activity, envisaging correspondence of scope and risk of exposure to individual production facilities (primarily fuel and energy, metallurgical and chemical complexes as ecologically most important sectors of the economy region) and territorial concentration of production in some parts of the region, primarily in the regional center, with the established environmental standards.

4. Develop and implement measures to strengthen regional institutional structures in the field of environmental protection, the development of environmental monitoring systems, the expansion of environmental control, including potentially hazardous industries and activities, regardless of departmental affiliation and ownership.

5. Forecasting level of expenses for environmental purposes of the area as a whole and the individual elements of its economic complex taking into account the planned production growth.

6. Formation mechanism of environmental responsibility of business entities for the negative impact on the environment and increase their interest in the conservation effort, including by improving the collection of payments for negative impact on the environment.

In accordance with the above environmental priorities in the Novosibirsk region the environmental activities should be primarily focused on:

- consistent reduction of negative anthropogenic impact on the environment;
- avoiding degradation of natural systems in the implementation of new investment projects;
- use of natural factors to restore and improve the health of people (primarily through the development of tourism and recreational zones formation);
- improving the quality of drinking water;
- struggle with flooding areas and natural focal infections (*tick encephalitis*).

Orientation to listed priorities will ensure the continued improvement of environmental quality in the area and on this basis the implementation of the principles of sustainable development of the region over the medium and long term, taking into account the solution of problems in the environment.

USING A PROGRAM-ORIENTED APPROACH AND THE POSSIBLE VARIANTS OF SOLUTIONS OF THE PROBLEMS

Integrated solution of the mentioned problems of natural resource management and environmental protection in the Novosibirsk region requires the use of program-oriented approach, which allows you:

1) to take into account the magnitude, complexity and diversity of environmental problems of the region, the solution of which requires the consolidation of efforts and funding sources for the development and implementation of complex interrelated specific tasks, resources, and implementing activities of different nature to achieve the goals;

2) to coordinate the goals and objectives of the Program with goals and objectives of the other long-term programs of the Novosibirsk region («Development and distribution of productive forces the Novosibirsk region», «Development of innovative activity in the economy and the social sphere in the Novosibirsk Region», «Development of transport infrastructure Novosibirsk Region», «Energy development, energy efficiency and energy security of the Novosibirsk region», etc.);

3) to combine the administrative and control tools of management and market economic principles, thus ensuring the coordination of various aspects of environmental activities of businesses;

4) to consistently integrate environmental objectives into the process of the socio-economic development of the area in order to ensure sustainable development;

5) to ensure the harmonization of setting and achieving balanced current and long-term environmental objectives;

6) to establish a clear priority in meeting the investment needs in the field of environmental protection, given the limited resources.

Thus, the program «Environment of the Novosibirsk Region» is seen as a key tool for planning, forecasting and implementation of regional environmental policies, as well as coordination of environmental activities in the Novosibirsk region. At the same time, the program acts as a method of implementation of the Strategy of socio-economic development of the Novosibirsk region for the period until 2025 and the Socio-Economic Development of the Novosibirsk region for the period until 2020.

The task can be solved by the several options corresponding mobilization (baseline) scenario Strategy of socio- economic development of the Novosibirsk region until 2025 [1]. Under this scenario, we consider two possibilities, reflecting the minimum and maximum options of mobilization scenario. Minimum scenario simulates the development of the Novosibirsk region on inertial type (reproducing the conditions and restrictions of 2000–2005). Maximum scenario describes the most complete use of the basic potential conditions for the development of the Novosibirsk region. Accordingly, there are two possible options for solving environmental problems.

The first option largely reflects current trends of development and distribution of productive forces of the Novosibirsk region and provides for the implementation approach to solving environmental problems, including mainly the establishment and improvement of methods and means to protect the environment at the end of the production cycle. In this case, the completion (or addition) of existing fixed manufacturing technologies or individual objects by different systems disposal of waste is carried out in order to prevent certain scale negative impacts on the environment (including treatment facilities for treatment of contaminated wastewater, installations for dust and gas extraction, water recycling system, the organization of waste management, construction of waste treatment plants, etc.) as well as activities to eliminate negative already committed violations in the state of the environment.

However, the possibility of the first variant, first and foremost in terms of economic and environmental efficiency of the technologies «end of pipe» are rather limited mainly due to the difficulties in achieving sufficiently high degree of purification of emissions and discharges, as well as in connection with an exponential relationship between the degree of extraction of harmful substances contaminants and level of expenditure for the necessary environmental protection measures.

At the same time, the failure to comply with of measures of this option significantly increases the risk of harm to the environment and human health. In addition, the cost of rehabilitation of territory in the event of violations (especially pollution) greatly exceeds the amount of investment required to prevent such violations.

In the capacity of the ecological risk assessments can be used indicators characterizing:

1) an increase in air pollution and acid rain formation (due to huge amounts of emissions of sulfur dioxide and nitrogen oxides produced during combustion, acid rain reduces the crop, destroys vegetation, destroys life in fresh water, destroys buildings, increases corrosion of metals and etc.);

2) changes in the qualitative and quantitative status of surface and underground water sources (under the influence of excess pollution, violations of the hydrological regime of rivers caused by different kinds of human impact, etc.);

3) formation of hazardous waste (toxic and radioactive) above permissible limits;

4) expected economic damage (calculated and prevented) from possible contamination of the environment (air, water, soil, mineral wealth, etc.);

5) the volume of greenhouse gases (carbon dioxide, nitrogen oxides, methane, chlorine, etc.) and their accumulation in the atmosphere above certain concentrations (established the environmental standards for relevant ingredients);

6) emissions of ozone-depleting substances (CFCs, chlorine and its compounds with oxygen, greenhouse gases); known that reducing the ozone layer by 1% leads to an increase of ultraviolet radiation by 1.5% and a corresponding increase in skin cancer from 2–3 to 5–7%. In addition, fall harvest crops, reduced phytoplankton productivity, the loss of many species of fish and marine invertebrates, etc. take place.

The procedure for evaluating the likely environmental risk is shown in Figure 6.

In the case of using the second variant of solution to the problem in addition to the measures of the first variant modernization and technical re-equipment of production through the introduction of resource-saving and low-waste technologies is provided. This variant is characterized by a high economic and environmental performance compared to the first, it will allow qualitatively change the ecological situation in the region through technical upgrading of existing facilities and the introduction of new facilities on the basis of high technologies for environmental safety operation of enterprises.

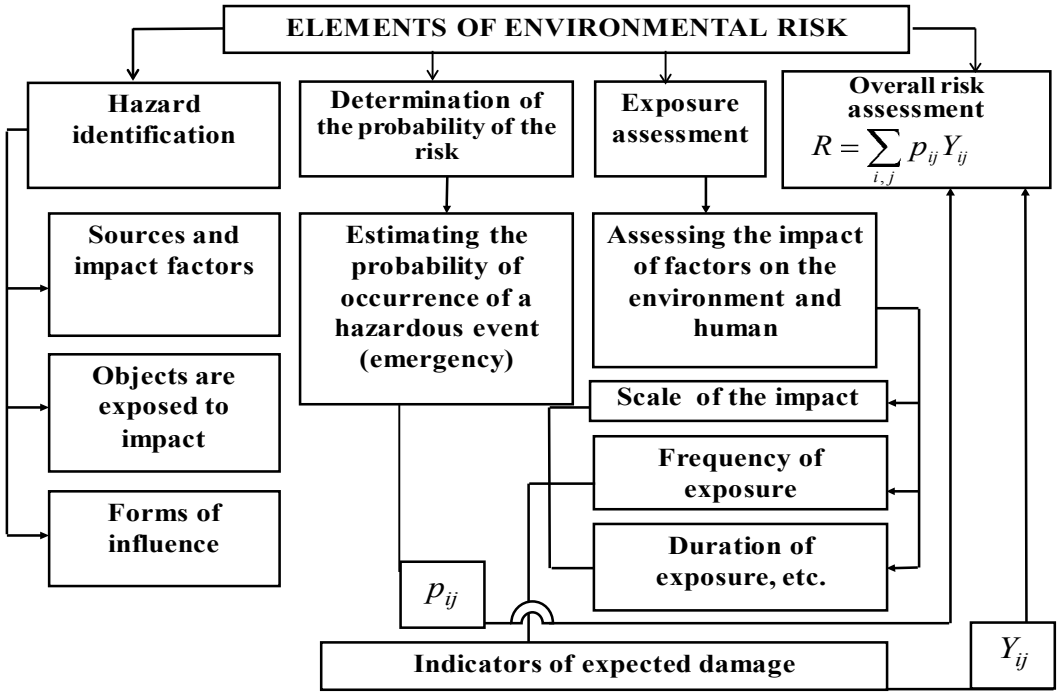

Fig. 6. Procedure for evaluating the environmental risk

Currently, however, the second solution to the problem seems to be premature in view of the fact that in modern Russian conditions, exacerbated by the effects of a deep global economic and financial crisis the implementation of such large-scale, technically complex and expensive programs without preparatory activities and to develop mechanisms public-private partnership has a high degree of economic risk.

In this regard, the advantage goes to the first embodiment of solving the problem, in accordance with which provides for the implementation of measures aimed at the progressive reduction to the lowest acceptable level of risk the negative impact of economic activities on the environment and the population of the region.

MECHANISM FOR IMPLEMENTING ENVIRONMENTAL STRATEGY

One of the most important conditions for effective implementation of the strategic developments in the region is to strengthen state regulation in the field of environmental protection. Of particular relevance in this connection acquires the solution of problems of the formation of the economic mechanism of environmental regulation aimed at promoting environmental management and environmental protection, promotion and support of environmentally responsible business, improving the organizational structure of management and legal foundations of environmental protection. The effectiveness of implementation of medium-and long-term forecasting documents in the field of ecology depends largely on the quality of an appropriate mechanism.

Mechanism for the implementation of the regional program requires a definite complex of legal, economic, organizational, informational, and other measures, which are an integral part of the national environmental policy. Achieving favorable ecological situation as a prerequisite for a decent quality of life and health is possible only on condition of concerted action of regional authorities, business and the public in the field of environmental protection. Main directions of the formation mechanism of the Program depend on both the measures taken at the federal level and on the powers of the subject of the Russian Federation , in cooperation with local authorities and, in our opinion, should primarily include:

- development and implementation of long-term and / or departmental target programs Novosibirsk region in cooperation with environmental problems;
- development and implementation of projects and plans of the executive authorities of the Novosibirsk region, local governments;
- implementation of investment projects and plans for development of enterprises that use natural resources;
- improvement of the legal base in the field of environmental protection and environmental safety;
- motivation of local governments, enterprises that use natural, scientific and expert community to actively participate in the implementation of planned activities;
- attracting resources of the federal and local budgets, private sector and civil society organizations for the implementation of programs and projects;
- maintaining continuous monitoring and analyzing the effectiveness of programs and projects.

Implementation of the strategic directions of environmental activities in the Novosibirsk region requires the creation of adequate financing environmental protection, which requires:

- attracting investment in the environmental sector, mainly due to companies' own funds, increasing the share of equity in natural resources conservation activities;
- a clear delineation between the sources of funding for the protection of ambient between the company's own funds, extra-budgetary and budgetary sources;
- improving the system of environmental charges and charges for using of natural resources;
- use of the federal budget, increasing the financing of interregional environmental measures at the expense of the federal budget as co-financing;
- strengthening the role of regional budgets in financing environmental programs and environmental protection measures, increase in funds for environmental measures as a part the budgets of the subjects of the Federation;
- improvement of regional environmental funds;
- increasing investment activity to the resource-saving technologies;

- attraction of credits of the banks;
- introduction of obligatory ecological insurance for series of potentially hazardous industries and technologies, etc.

For the purpose facilitating and supplement intraregional environmental financing are considered as key direction the mobilization of domestic resources which are the main source of funding for environmental activities, as well as more effective use of external resources. The main focus should be placed on expanding the budget and resource base and on improving the use of budgetary funds.

TARGETED ENVIRONMENTAL INDICATORS

As the criteria for assessing the performance carried out in the region environmental policy from the standpoint of achieving the goals and objectives can be used indicators characterizing the ecological processes in the region, including a set of parameters designed to provide an adequate assessment of the state of the environment.

The objectives of environmental and economic efficiency evaluation of the Program implementation are to obtain quantitative criteria for deciding on the admissibility or inadmissibility of an activity, to select an option to ensure the planned economic activity at the lowest cost, to obtain quantitative criteria for evaluating the effectiveness of planned conservation programs.

The main generalized indicators of performance implementation of the Program in the region can be indicators characterizing:

1) specific yield of pollutants into the environment (air, water pool – respectively in tons and cubic meters per person per year);

2) reducing the volume of pollution released to the atmosphere per unit of GRP from stationary sources;

3) reducing the volume of pollution released to the atmosphere per unit of GRP from mobile sources;

4) average annual increase (decrease) in the volume of polluted water bodies per unit of GRP;

5) reducing the unprocessed waste of production and consumption.

Reduction of pollutants into the environment per unit of the GRP means strengthen-ing ecological compatibility of the technologies used, increase the efficiency of abatement equipment, reduction of energy intensity of production, improving quality of the environment, reducing the negative impact of the economy on health. Increasing the degree of processing and disposal of waste would entail reducing the environmental hazards of waste accumulation, will serve as a characteristic of the management system effectiveness on waste.

Increasing the degree of processing and disposal of waste will entail reducing the environmental hazards of waste accumulation that will serve as a characteristic of the effectiveness of waste management. Exit to the envisaged target environmental landmarks will testify about the possibility of not only preserving the achieved quality of the environment, but also its progressive improvement.

Furthermore, to assess results in achieving the goals and objectives of the program can be used by specific private indicators characterizing the various aspects of the environmental impact of the region, taking into account its economic, social and environmental specificity.

To solve the tasks is required get off at target environmental landmarks – the performance indicators of environmental quality management, which are presented in Table 2 (forecast estimates executed on the basis of the mobilization scenario Novosibirsk region).

Table 2

Forecasted target environmental indicators for the Novosibirsk region

Indicators	2010–2013	2014–20016	2017–2020
Average annual increase in the volume of emissions into the atmospheric air from stationary sources per unit of the GRP	8–10	7–9	5–7
Average annual increase in the volume of emissions into the air from mobile sources per unit of the GRP	13–15	12–14	10–12
Average annual increase in the volume of waste water discharged into water bodies per unit the GRP	16–18	12–14	9–11
Volume of reduction of the unprocessed waste production and consumption, thousand tons	120–150	160–200	210–250

In particular, the calculations carried out for the forecast of air pollution in the Novosibirsk region on the most common pollutants emitted from the stationary sources in the 2005–2025 period, with taking into account of the parameters of the mobilization scenario [1] indicate the real possibility of the formation of the trend of the gradual improving air quality in the region (Figure 7).

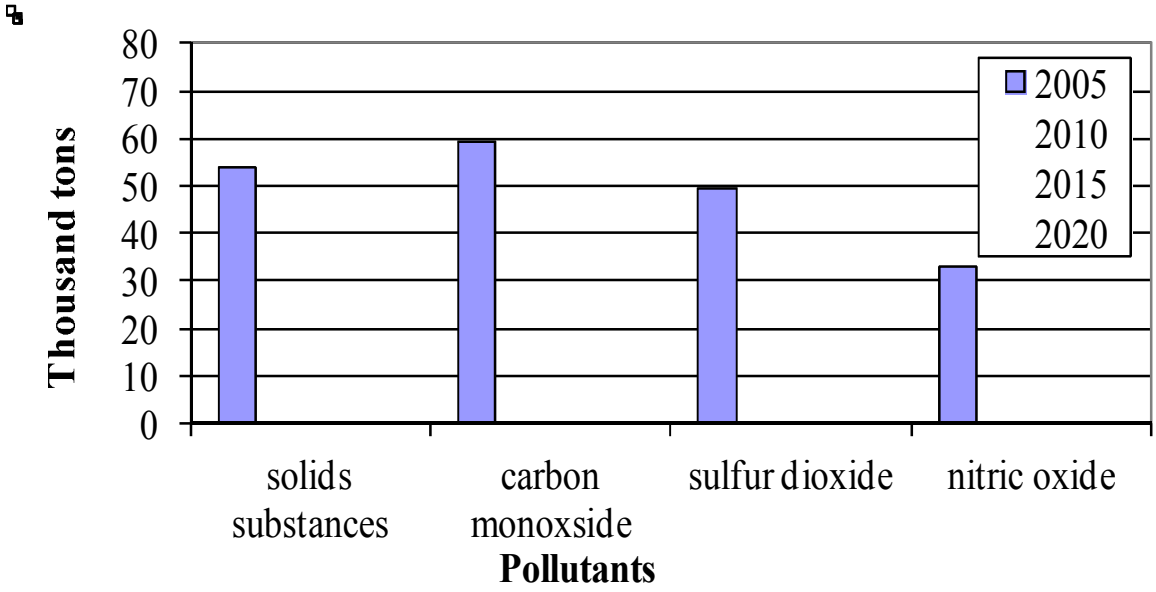

Fig. 7. Forecast of air pollution by the major pollutants by 2025

Targeted environmental indicators reflecting the strategic environmental priorities and key environmental issues are intended for use by regional authorities as a tool for monitoring activities in the field of sustainable development of the territory. This provides an opportunity to timely develop and revise the program of activities aimed at achieving the environmental objectives of development in the region, if the activity is not effective enough. At the same time, the indicators used must be accessible and understandable for a wide range of other stakeholders, including civil society organizations and people of the region. Providing such understanding is a very important condition, because the process of ensuring environmental wellbeing in equal measure depends on the actions of individual persons, and from the work performed by the regional authorities. The corresponding struc-

tural units of administration of federal subject are collecting data and preparing reports on the actual values of indicators of sustainable development for all stakeholders to get an idea about the effectiveness of the implementing the program.

Achieving the goals and objectives will help to solve the problem of improving the environment within the Novosibirsk region, to reduce human-induced pressures to maintain an acceptable level of air pollution from stationary and mobile sources of emissions, organize the rational use and protection of water resources, improve the system of treatment of waste production and consumption, as well as identify areas for improvement of governance in the field of environmental protection. Orientation to manufacture high-tech products, realizations of the gasification project industrial and household sectors of the field and other projects provided for in the Novosibirsk region in the long term, will contribute, along with conservation measures and improve environmental performance of the economy of the Novosibirsk region. Exit on the intended target environmental guidelines will testify about the possibility of not only preserving the achieved quality of the environment (primarily due to air quality), but also its progressive improvement.

REFERENCES

1. **Strategy** for Socio-Economic Development of the Novosibirsk region for the period until 2025. – Novosibirsk, 2007 (from 03.12.2007 № 474). Section 8.4. Ensuring environmental safety and environmental protection. URL: http://economnso.ru/files/1654.pdf.
2. **Program** of the socio-economic development of the Novosibirsk region until 2015 – Novosibirsk, 2009. – Policy in the sphere of environmental protection. URL: http://economy.newsib.ru/files/99713.pdf. – Раздел II.7.
3. **The concept** of environmental protection of the Novosibirsk region for the period until 2015. Approved by the order of the Governor of Novosibirsk region from 17.11.2009 № 283-p. URL: http://www.sibfo.ru/strategia/strdoc.php.
4. **Strategy** for Socio-Economic Development of Siberia until 2020 (Section IV. Interbranch Priority directions of development of Siberia - Addressing environmental issues) – Approved by the Federal Government on July 5, 2010 № 1120-p. URL: http://www.sibfo.ru/strategia/strdoc.php).
5. **Economics** of Siberia: strategy and tactics of modernization / [ed. count.: A.E. Kontorovich, V.V. Kuleshov, V.I. Suslov]; IEIE SB RAS. – Moscow – Novosibirsk: Ankil, 2009. – 317 p.
6. **Seliverstov V.E.** Regional strategic planning: from methodology to practice. / ex. ed. V.V. Kuleshov. – Novosibirsk: IEIE SB RAS, 2013. – 435 p.
7. **Seliverstov V.E.** Strategic development and strategic planning in Siberia: experience and problems. / ex. ed. V.V. Kuleshov. – Novosibirsk: Publishing House of SB RAS IEIE, 2010. – 495 p.).
8. **Seliverstov V.E., Melnikova L.V.** Analysis of Strategic Planning in Regions of the Siberian Federal District // Regional Research of Russia. – 2013. – Vol. 3, No. 1. – P. 96–102.
9. **Seliverstov V.E.** Regional monitoring: Information management framework for regional policy and strategic planning // Regional Research of Russia. – 2012. – Vol. 2, Is. 1. – P. 60–73.
10. **State Report** «On the state and Environmental Protection of the Russian Federation in 2009». URL: http://www.mnr.gov.ru/regulatory/list.php?part=1101.
11. **State Report** on the environmental situation of the Novosibirsk region in 2008 – Novosibirsk, 2009. – 129 p.
12. **State report** «State of the Environment of the Novosibirsk region in 2009». – Novosibirsk, 2010. – 150 p.
13. **State report** «On the State and Environmental Protection of the Novosibirsk region in 2011». – Novosibirsk, 2012. – 148.
14. **State report** «On the State and Environmental Protection of the Novosibirsk region in 2012». – Novosibirsk, 2013. – 184.
15. **State Report** «On the state and Environmental Protection of the Russian Federation in 2012». – URL: http://www.mnr.gov.ru/regulatory/list.php?part=1101.
16. **Burmatova O.P.** Strategic aspects of environmental activities in the region. – Novosibirsk: IEIE SB RAS., 2011. – 72 p.